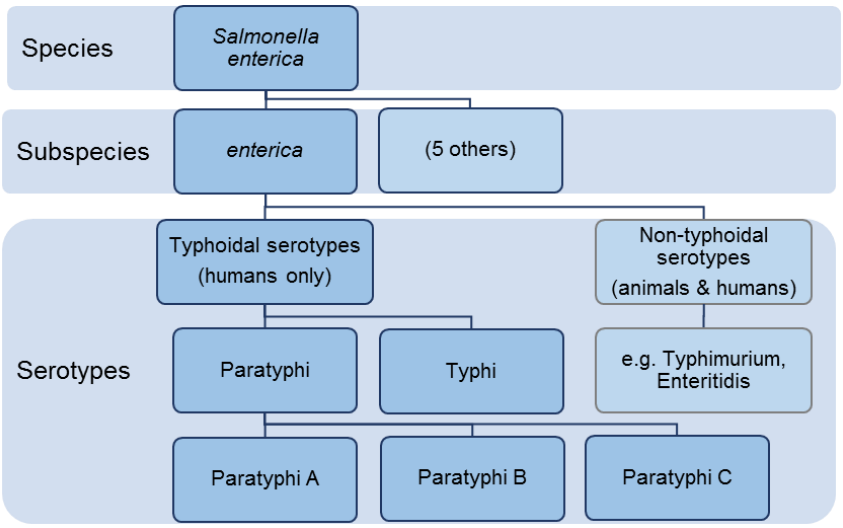
TYPHOID AND PARATYPHOID FEVER AND FOOD SAFETY

New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE

TYPHOIDAL SALMONELLAE BACTERIA CAUSE ENTERIC FEVER IN HUMANS

Salmonella enterica can be divided into typhoidal and non-typhoidal serotypes.



The typhoidal serotypes, *Salmonella* Typhi and *Salmonella* Paratyphi are only found in humans, while non-typhoidal salmonellae infect or colonise humans and animals.[1]

People are infected with typhoidal salmonellae when these bacteria are ingested, usually with food or water.[2] Ingestion of fewer than 1,000 cells could cause illness.[3,4] The bacteria spread from the intestine throughout the body, causing enteric fever (typhoid or paratyphoid fever). Fever and headache are common symptoms. Diarrhoea or vomiting can occur, as can life-threatening complications.[5]

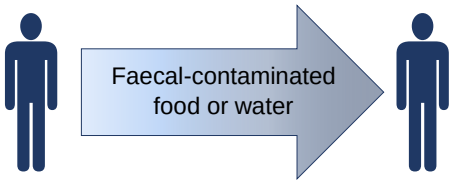
Notes: *S.* Sendai is another typhoidal serotype but is rarely found.[6] *S.* Paratyphi B dT$^+$ (also called *S.* Paratyphoid B *var.* Java or *S.* Java) is serologically identical to *S.* Paratyphi B but is not confined to humans and usually causes gastroenteritis.[7]

PEOPLE CAN SHED TYPHOIDAL SALMONELLA IN THEIR FAECES FOR MONTHS

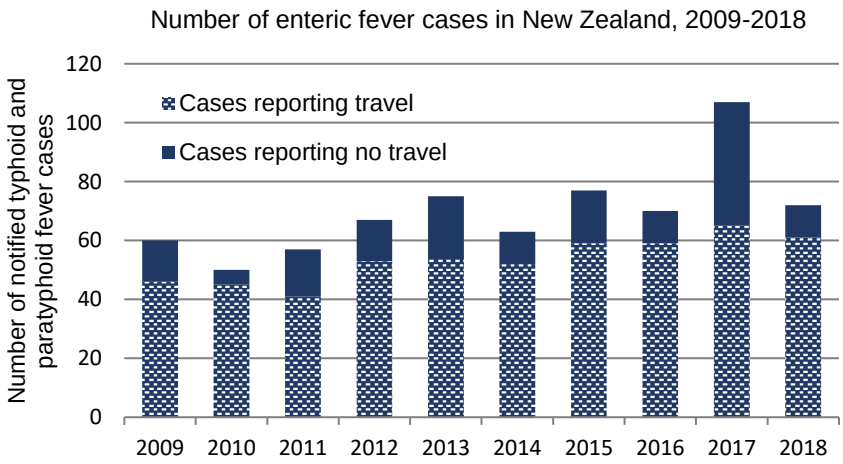
The incubation period before symptoms appear is commonly 6–24 days but can be as short as 1 day or as long as 60 days.[8,9] People can excrete typhoidal salmonellae with their faeces before, during and after showing symptoms.[2] People can also excrete these bacteria without showing symptoms (asymptomatic infection). Faecal shedding stops within a few days of antimicrobial therapy but can continue for up to three months in untreated people.[10] Some untreated people can continue to carry typhoidal salmonellae and occasionally shed the bacteria in their faeces for up to a year (temporary carriers) or many years (chronic carriers, usually with gall bladder problems).[11]

TRANSMISSION IS MAINLY VIA FAECALLY-CONTAMINATED FOOD OR WATER

Humans are the reservoir for typhoidal salmonellae.[9] Foodborne transmission is caused by infected people handling food after toileting and not effectively cleaning their hands, or where food comes into contact with human sewage. In world regions where enteric fever is common and water and waste infrastructure is poor, infection also spreads through contaminated drinking water. Person-to-person transmission is not common.



MOST NZ CASES ARE TRAVELLERS FROM OTHER COUNTRIES BUT CONTAMINATED FOOD HAS CAUSED OUTBREAKS



In New Zealand, for the period 2009–2018, there were between 0.8–1.3 typhoid cases per 100,000 people per year, and 0.3–1.0 paratyphoid cases per 100,000 people per year.[12] During 2009–2018, 77% of cases reported being overseas during the incubation period.

The peak in domestic cases during 2017 was linked to two foodborne outbreaks. One involved 22 cases of typhoid fever linked to a church group (food not known) and the other involved 11 cases of paratyphoid fever from eating wild (non-commercial) mussels collected from faecal-contaminated harbour water.[13-15]

Domestic outbreaks, when cases have not travelled, have also been reported in other developed countries. These are often foodborne.[16,17] When the cause was identified, cases either ate food containing a contaminated ingredient or that was prepared by an infected food handler (often asymptomatic or a chronic carrier).[18,19]

TYPHOIDAL SALMONELLAE CAN SURVIVE FOR MONTHS ON FRUIT BUT DATA ARE SCARCE

Typhoidal salmonellae have been detected on fresh produce in countries where typhoid fever is endemic but there are few published surveys.[20,21] No prevalence data were located for developed countries, where contamination would be sporadic and unlikely to be detected through a food survey unless a problem was suspected.

Laboratory experiments showed that *S.* Typhi survived on the surface of whole strawberries, mangos and kiwifruit under refrigeration until the end of the experiments, which ranged from 15 days to 16 weeks.[22-24] The bacteria tended to die over time, with a large die-off early in the experiment followed by a much slower rate of death. It is not known how long is needed for all typhoidal salmonellae to die on whole fruit. Typhoidal salmonellae might grow on damaged or cut fruit, depending on the temperature or pH, but data are needed to confirm this.[23]

GOOD WORKER HYGIENE PREVENTS TRANSFER OF TYPHOIDAL SALMONELLAE FROM SOILED HANDS

Hands can remain contaminated after defecation and regular washing.[25] Salmonellae can transfer between bare hands, gloves or cloth to fresh produce, from gloved or ungloved hands to fomites (e.g. handles), and from fruit to cloth (e.g. to picking bags).[26-29] More bacteria are transferred in moist conditions.

Gloves reduce bacterial transfer from soiled hands to fruit or other surfaces but can be contaminated when taken on and off (e.g. when using the toilet) and can become a source of microbial contamination when not frequently changed or washed.[30,31] Bacteria can move through cloth gloves from the hands.[32]

In day-to-day operations the risk of typhoidal salmonellae being transferred from an infected worker can be reduced through: ◆ teaching and encouraging good hand hygiene ◆ teaching good glove hygiene ◆ providing suitable and easily accessed toilet and handwashing facilities and enough time for handwashing ◆ providing a sick worker policy that encourages workers to stay away if they are unwell and to be checked by a doctor who is aware they are a food handler. These good practices will also reduce risks from other communicable diseases.

SPRAYS AND SANITISERS MIGHT BE EFFECTIVE FOR TREATING POTENTIALLY CONTAMINATED FRUIT

In a scenario where an infected worker is directly handling fruit, only some of the fruit could be contaminated with typhoidal salmonellae. This depends on the concentration of bacteria on the worker's hands/gloves, and on things that affect bacterial transfer, like moisture and pressure during contact. It will be difficult to locate and test these fruit to provide market assurance.

The potential for a low number of typhoidal salmonellae cells to cause illness requires high confidence that almost all bacterial cells will be dead before releasing the fruit to market. Studies show typhoidal salmonellae might survive for months on fruit at refrigeration temperatures and it is not currently possible to define a suitable fruit withholding period.

Sanitisers used for water or surface sanitation could kill typhoidal salmonellae but might not be suitable for use on fruit because this might require off-label use or leave unacceptable residues. Sodium hypochlorite has been shown to kill *S.* Typhi on the surface or fruits and vegetables but does not eliminate these bacteria.[21-23,33-35] Peroxyacetic acid can kill non-typhoidal salmonellae so should also kill typhoidal salmonellae.[36,37] Trials are needed to confirm sanitiser effectiveness.

Some Generally Recognised As Safe (GRAS) substances might also kill typhoidal salmonellae if sprayed on fruit but research is needed to confirm this. Acetic acid (vinegar) and citric acid are examples.[21-23,33-35,38]

This information sheet was prepared by Nicola King, Institute of Environmental Science and Research (ESR) for the NZFSSRC.

Handwashing/magnifying icons were freely available from www.iconfinder.com/p/coronavirus-awareness-icons.
All other images are original.

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